

## CONTRIBUTIONS TO THE KNOWLEDGE OF THE *SIPHONAPTERA*.

By THE HON. N. C. ROTHSCCHILD, B.A., F.E.S.

(Plates XVA. XVI. XVII.)

DR. K. M. HELLER of Dresden published the description of a new flea, *Typhlopsylla agyrtes*, in *Entomologische Nachrichten* for 1896. At the request of Dr. Heller I undertook to investigate this species more thoroughly. Since I received the two specimens of this flea which Dr. Heller kindly gave me for my proposed investigation, I have ascertained that this species was long known in England. It was, however, identified with *Typhlopsylla assimilis* Taschbg. During the course of my investigation I was fortunate enough to find out a few hitherto unrecorded facts about the morphology of the exoskeleton of the *Palicidae*. These few facts, together with two descriptions of new species and a few notes on some of the less known British members of this group, form the subject of the present paper. Through the kindness of my friend Dr. Jordan I have been able to add a series of drawings illustrating the text. Dr. Jordan, moreover, has throughout given me much assistance and advice, for which my best thanks are due to him.

### EXOSKELETON OF *TYPHLOPSYLLA AGYRTES*.

Dr. Wagner has already given careful figures of the head and the *male* sexual armature of this species in his paper on Aphaeniptera, *Hor. Soc. Ent. Ross.* XXXI. Pl. IX. f. 23, 24 (1898). I must consequently apologize for re-stating some of his discoveries.

A very remarkable feature of the morphology of the head of *T. agyrtes* and its allies is the tubercle (Pl. XVA. f. 1) at the edge of the antennal groove. This tubercle has the appearance of a rudimentary spine, it is much thickened, and forms a dark prominence. A further peculiarity of this structure is its position, which coincides with that of the round eye of the members of the genus *Palaeo*. The rudimentary spine, moreover, exhibits some black pigmentary matter within it. Is it possible that this spine is the vestige of a once functional eye?

The prothorax consists of a dorsal half-ring, the pronotum, and a very prominent ventral piece, the prosternum, at the anterior end of which the forelegs are inserted. Pl. XVII. f. 20 gives a ventral view of the prosternum of *T. agyrtes*. The sternum is, as the figure shows, divided by a mesial ridge into two halves. These are ventrally concave, and extend laterally to the pronotum. The portion I term the prosternum is in point of fact not the "sternum" proper, but corresponds to the postcoxal pieces of the prothoracic sternite of other insects. In the present article, however, the term prosternum has been adopted for the whole ventral part of the prothorax. The coxal cavities of the prosternum (c-c) are closed behind, as opposed to those of the meso- and metasternum, which are quite open. The cavities of the meso- and metasternum are not separated from each other by any chitinous pieces, since the sterna have not developed any long intercoxal processes. Pl. XVII.

f. 20 shows the mesosternum when viewed from a ventral position. This has the form of a very narrow half-ring. In the mesosternum there are no lines of division externally visible; the various pleural or ventral pieces are fused together, the two portions shown in f. 20 being the mesosternum and the epimeron (msl + epm).

When viewed from the front (Pl. XVII. f. 23) the mesosternum has the appearance of a transverse plate which is not produced ventrally in the middle, there being no intercoxal process. Indications of a division of the plate are visible at both the lower and upper edges.

The metasternum is also narrow when viewed from a ventral position, but is much longer than the mesosternum. Pl. XVII. f. 20 demonstrates the fact that the sternum forms a mesial tubercle and is well separated from the epimeron (epm).

In f. 21, which represents the metasternum in side view, the sternum is shown ventrally produced into an intercoxal triangular tubercle. The figure further shows the position of the epimeron (epm) and the episternum (epst). The episternum is a small piece lateral in position widely separated by the epimeron and sternum from the coxal cavities.

In a frontal view (f. 22) the epimeron, which lies behind the sternum, is not visible; the episternum, however, is plainly visible between the metasternum and the metanotum.

The three plates of the metathorax shown in Pl. XVI. f. 6, the side view of *Ceratopsylla elongatus*, I have termed in the present paper sternum, episternum, and epimeron. The homology of these parts as accepted by me has hitherto not been recognized by others. I consequently give my reasons for introducing this somewhat new departure. The genus *Ceratopsylla* perhaps shows the plates in question best. In the accompanying diagrammatical figure of the metathorax of

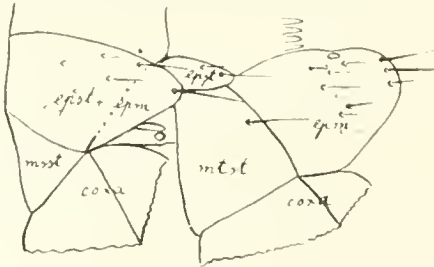


FIG. 1.

*C. elongatus*, the above-mentioned three plates are represented. These in fact are present in all our fleas, and have always the same position. They vary, however, in outline and in respect to the bristles they bear. The large plate (epm), the epimeron, bears the metathoracic stigma at its upper edge. It was often considered to be a rudimentary wing by the older authors. Dr. Landois \* erroneously treated it as the ventral plate of the first abdominal segment. The inner surface of the epimeron serves for the insertion of the coxal muscles. The second plate (epst), the episternum, does not seem to have been clearly recognized by others as a separate plate of the metathorax, though it is certainly indicated in many of Taschenberg's figures. The coxal cavity is formed by the metasternum and the

\* *Anatomie des Hundeflohes*, p. 8 (1866).

large flap, the epimeron. The flap, therefore, has the position which the epimeron of other insects generally has. In many insects the episternum takes part in the formation of the coxal cavity, but in others it does not. The plate I have termed the episternum does not take part in forming the coxal cavity. Its position, however, is dorsal to the lateral portion of the metasternum, as is the case in other insects. This plate can therefore very well be the homologue of the episternum, in spite of the distance at which it is placed from the coxal cavity. The mesosternum (Fig. 1) of *C. elongatus* consists of two distinctly separated pieces, a ventral and a lateral one, designated in the figure msst and epst + epm. The suture separating the two is only marked ventrally in *T. agyrtes*, at the very edge of the plates above the coxa. The large lateral plate is internally divided by a ridge (punctured in Fig. 1) into an anterior and posterior piece; the ridge resembles those which are observed at all sutures of the thorax. It is, therefore, possible that this internal ridge of the lateral plate of the mesothorax is an indication of a suture of which all traces are now lost externally. From this we might infer that the lateral plate originated by a fusion of two plates both of which reached the coxal cavity. These two plates would have had the position which the episternum and epimeron of other insects have. The posterior of the two (epimeron) would correspond with the flap (epimeron) of the metathorax. The mesothoracic epimeron has no stigma on its upper side, but there is a stigma on the membrane behind the coxa which is covered in a lateral view by the lower edge of the epimeron. This membrane is strengthened by a piece of chitin that runs from the epimeron to or almost to the stigma. It might be urged that this piece of chitin was the homologue of the metathoracical flap, and the circumstance that it is the supporter of the mesothoracical stigma seems to be in favour of this contention. I think it therefore best to leave it for the present undecided whether the plate designated in Fig. 1 as epst + epm. = episternum + epimeron, corresponds to both the episternum and the epimeron, or whether it is the episternum, and the chitinous piece near the stigma represents the epimeron. The question cannot be solved without a full comparison of many different forms of fleas, which I have not yet carried out.

The epimera of the metathorax extend so far back that the short metanotum does not cover the space between itself and the metasternum. On this account the first abdominal segment has been pushed forward to form a dorsal covering to the metathorax. The ventral plate of the segment is wanting. Landois, *l.c.*, mistook the epimera of the metathorax for the ventral plate, as I have already mentioned.

In addition to the first abdominal segment there appear to be nine more segments, of which the last three (or four) are largely modified in both sexes. The first seven tergites, like those of the thorax, have two principal rows of bristles, as shown in f. 1. 3. 4. 6. 7. 11. The lowest bristle of the posterior series is placed below the stigma. The sternites, on the other hand, are provided with a few bristles. In fact the sternite of the second segment of *T. agyrtes* has one or two bristles only. All these bristles lie close upon the segments, and the rows of long ones have perhaps the function of preventing the hairs of the host getting between the segments. At the apical edge of the seventh tergite there are dorsally, on each side, one long and two short bristles, which may possibly serve as a protection for the peculiar sensorial plate of the pygidium. In other species of fleas the number and proportional length of these antepygial bristles varies considerably, and furnish obvious distinguishing characters. In the sexes these bristles are also often different. *Typhlopsylla pentacanthus*, for instance, has no

bristles in the *male* (Pl. XVa. f. 3), while in the *female* there are two on each side. In the case of *T. spectabilis* again the *male* has three and the *female* five bristles on each side in this position. The number of the bristles on the sternites is from two to six. Here again the numbers vary in the sexes.

While the third, fourth, fifth, and sixth sternites are covered by their respective tergites, the reverse is the case in both sexes with regard to the second segment. In this case the sternite covers the lower portion of the tergite (Pl. XVa. XVI. f. 1, 3, 4, 6, 7, 11). The seventh segment of the *male*, like the preceding five segments, has its tergite covered by its sternite, and is normal in structure. In *T. agyrtes* and other members of the same genus the seventh sternite of the *female* exhibits some peculiar characters. In this case the sternite covers the tergite, while in the *male*, as I have previously mentioned, the tergite covers the sternite. This seventh sternite is narrower mesially than at the sides. The dilated lateral portion is deeply sinuate, thus consisting of an upper broad and a lower narrow lobe (Pl. XVa. f. 2). In *Typhlopsylla pentacanthus* and *T. dasycnemus* the lobes are also present (Pl. XVa. f. 5); they differ, however, in shape in each species. In the genus *Ceratopsylla* (Pl. XVI. f. 6, 7) the seventh sternite is still more enlarged, but its outer edge is not sinuate.

The eighth segment of the *female* of *agyrtes* differs entirely from the other segments. The sternite is reduced to two narrow bottle-shaped pieces, which bear a few short hairs at the top (Pl. XVII. f. 24. viii. v). The sternite therefore is mesially divided, which is not the case with segments 2 to 7. In a lateral view the sternite would be hardly noticed (Pl. XVa. f. 2. viii. v). The separation of the sternite into two halves does not seem to be complete in all fleas: in *Pulex goniocephalus*, for instance, the two narrow plates remain united at the base.

The eighth tergite is correspondingly enlarged, forming a complete ring, the ventral edges of which nearly touch each other: in fact they almost conceal the sternite from view. The upper portion of the tergite is narrower than the lower part. It is divided, moreover, in the middle, the division nearly reaching the base. This peculiarity is well shown in Pl. XVII. f. 25, which represents the dorsal view of the eighth segment. In the figure the two stigmata, which lie close to the middle sinus, are also represented. These, taken with the trachea, are hammer-shaped in appearance. Their mouths are densely clothed with fine hairs. The bristles near the ventral edges of the eighth tergite, shown in Pl. XVII. f. 24 and 25, are generally quite constant in length, number, and position. The difference in the mesial portion of the eighth tergite of the two sexes of *T. agyrtes* is very conspicuous (Pl. XVII. f. 14. viii. d, and f. 25. viii. d).

The portion following the eighth segment corresponds to the ninth and tenth segments in the *male*, of which mention is made further on. The structure, however, of this portion of the abdomen in the *female* is different from the structure of the end of the abdomen in the *male*. In fact I am not yet prepared to give a decided opinion on the homology of these portions of the morphology of the *female*. In the view from above, Pl. XVII. f. 17, a plate (a) is represented on each side, the two plates being separate in the middle line. In addition to this a larger undivided plate (b) is shown, in the middle of which the ovate sensal plate is placed. Finally the two palpi-like processes (c) are shown. In a lateral view, Pl. XVII. f. 18, the same plates are represented. In addition to these, however, two more plates are present, marked in the figure a' and b'. The plate marked a' is ventral to the plate marked a: and the plate b' is likewise ventral to b.

The anus is situated between  $b$  and  $b^1$ . When the abdomen is viewed from below, Pl. XVII. f. 19, two portions only are visible, the basal portion marked ( $a^1$ ) and the larger apical plate ( $b^1$ ), besides the two processes ( $c$ ).

As I have previously stated, I am not at present prepared to describe the homology of the plates marked  $a$ ,  $a^1$ ,  $b$ , and  $b^1$  on Pl. XVII. f. 17, 18, 19. It is tempting to suppose that they represent the ninth and tenth segments, but this conclusion is, I think, not correct: for in the *male* the sensory plate is part of the ninth tergite, and it is not impossible that the processes  $c$  of the *female* are homologous to the tenth segment of the *male*.

In the *male* of *T. aggrtes* the sternite of the eighth segment is very much enlarged and conceals to a great extent the ninth segment (Pl. XVa. f. 1). It is a large concave piece of chitin, sinuate in the mesial line, forming a large cavity which opens dorsally and apically. The bristles of the eighth sternite are characteristic of each species. They differ in number and position in each species of *Typhlopsylla*. The eighth tergite is rather small, and is of a singular appearance, in consequence of the peculiar development of the stigmata. A dorsal view of this portion is given on Pl. XVII. f. 14. The two stigmata are not simple circular openings. They are much dilated along the edge of the segment, both dorsally and ventrally, and meet in the middle line, where the segment is deeply sinuate. The sinus, which does not reach halfway across the segment, forms part of the stigma-cavity, which is densely clothed with fine hairs. The development of the eighth segment in the *male* as here described seems to be peculiar to the genus *Typhlopsylla*. The genera *Ceratopsylla*, *Pulex*, and *Ceratophyllus* have a very small eighth sternite, consisting of two separate narrow plates (Pl. XVI. f. 10. viii. v). The eighth tergite in these genera is very large. In *Ceratopsylla elongatus* ♂ (Pl. XVI. f. 10) the eighth tergite is divided dorsally in the middle: each plate thus formed is sinuate. The sinus separates from the plate a lobe which protrudes dorsad. At the base of the lobe the comparatively small stigma is placed. The sexes of *Ceratophyllus*, *Pulex*, and *Ceratopsylla* agree with one another with regard to the relative size of the sternite and tergite of the eighth segment. In this respect these genera differ markedly from *Typhlopsylla*.

If the eighth sternite and also the lower part of the eighth tergite of *Typhlopsylla aggrtes* be removed, the copulatory apparatus of the *male* and the pygidium are seen. Pl. XVII. f. 12, 14 represents them in situ. Between the eighth tergite (Pl. XVII. f. 12. viii. d) and what is distinguished as  $x$  in the same figure the sensal plate is situated. The lateral portion of ix. d, which is separated from the dorsal portion by a deep sinus, is again divided into two processes  $p$  and  $p^1$ , and produced internad into a long curved process on each side, the manubrium of Wagner. The dorsal and lateral portion of ix. d form one plate, the ninth tergite, moveable only in toto. Dr. Wagner has figured this apparatus as here described quite correctly, and I repeat it only for the sake of completeness. Joined to the large and complicated ninth tergite is a boomerang-shaped organ (Pl. XVII. f. 12. ix. v) which is provided with hairs at the apex in a characteristic way. Another moveable piece of chitin is also joined to ix. d, namely the organ  $f$ , which lies at the inner and ventral side of the process  $p^1$ . The hairs upon the moveable "finger"  $f$  are connected with the interior of the organ, which is hollow, and seem to be sensory hairs. Just behind the dorsal sensal plate there is a transverse suture which separates the anal convex plate  $x$  from ix. d. This suture is also plainly visible, when viewed from above (Pl. XVII.



f. 14). On each side of the anal plate x a flap is present. These flaps may either be the lateral parts of the anal plate turned up in consequence of the pressure the mounted specimen is subjected to, or they may be separate plates ventral to x.

It is obvious that the portion designated in f. 12 on Pl. XVII. as ix. d is really the dorsal ninth segment, and the boomerang-shaped organ the ninth sternite. The anal plate x must be a tenth segment, as it is separated by a suture from the ninth, the line of separation being ascertained from longitudinal sections. The plate x, moreover, has been further observed in a live specimen to flap up and down, while the ninth tergite with its sensual plate showed no movement. If the lateral flaps beneath the tenth tergite, which covers the anus from above (Pl. XVII. f. 12. 14), are separated from x, they must represent the tenth sternite. If, however, they are only the sides of x, it might be suggested that the finger-like organ f of ix. d was a modified tenth sternite.

In the genus *Typhlopsylla* and other genera of *Pulicidae* not only the ninth tergite of the *male* affords good distinguishing characters, but also the ninth sternite, as can be ascertained by a comparison of Pl. XVII. f. 12. 13.

#### GENUS TYPHLOPSYLLA.

##### 1. *Typhlopsylla agyrtes* (Pl. XVA. fig. 1 ♂, 2 ♀).

? *T. assimilis* Taschenberg (et alii), *Die Flöhe* p. 95 (1880) (partim).

*T. assimilis* Saunders (not Taschenberg), *Ent. Mon. Mag.* (2). II. p. 170 (1891).

*T. agyrtes* Heller, *Ent. Nachr.* XXII. p. 97 (1896) (Borkum); Wagner, *Hor. Soc. Ent. Ross.* XXXI. p. 35. t. 9. f. 23 (1898).

The front of the head is rounded, and has in front of the antennal groove two parallel rows of bristles. The first row consists of five bristles, and the second of three. Immediately in front of the antennal groove is a small spine-like tubercle, the exact position of which can be best made out from the figure. The gena has at its posterior edge **three** spines which stretch backwards.

Near the hinder edge of the head is a row of four bristles. The most ventral of these is very long. Between this row of bristles and the antennal groove there are five or six longer bristles. The upper four of these stand in an oblique position. The antennal groove is dorsally bordered by a series of fourteen (♂) very thin short hairs; in ♀ there are some additional short bristles behind.

The pronotum bears a row of five long hairs, between every two of which a short hair is placed. At its posterior margin is a comb of **sixteen** teeth. This number appears to be invariable. The dorsal portion of the mesothorax has two rows of hairs on it; the first consists of short hairs, the second of long ones. The anterior portion of the mesonotum, moreover, bears numerous small hairs scattered irregularly over its surface. The episternum ( + epimeron, *vide* p. 535) is a moderately large plate, the shape of which can be best seen in the figure; it bears ten hairs.

The metanotum bears, like the mesonotum, two rows of hairs. Besides these there are some more hairs on this portion of the thorax placed just beyond the middle. The episternum is a small semicircular plate with two bristles at its end. The epimeron is large and shaped as in the figure; it bears five hairs.

The first seven tergites of the abdomen of both sexes, as usual, have two rows of bristles on them. The first of these rows consists of small bristles of a uniform size. The second row contains alternately long and short bristles. The number of these

bristles appears to vary slightly according to individuals. At the posterior edges of the first, second, third, and fourth tergites there is a small spine placed close to the middle line on each side. At the posterior edge of the seventh tergite there are on each side close to the middle line one long and two short bristles.

The enlarged eighth sternite in the *male* bears about seven small and three large bristles. At the posterior end of the boomerang-shaped ninth sternite there are about four long and five short bristles. The eighth tergite in the *female* is, as usual, much enlarged; it bears nine hairs near its ventral edge.

The coxae of the forelegs are covered with numerous bristles on their outer edge. The tibiae have at their posterior edges seven pairs of strongly chitinated bristles. The inner bristle of the second, fifth, and seventh pair is longer than the others. On the outside of the tibiae there is a series of seven smaller bristles. The middle and hind legs are similar in structure to the first, but the coxae are practically naked.

Length 2.25—2.35 mm.

*Hab.\* Hypudaens glareolus*, Tring, North Berwick, and Hanover; *Mus silvaticus*, Tring; *Mus musculus*, Tring; *Arvicola amphibius*, Tring and Brighton †; *Sorex vulgaris*, Tring; *Crossopus ciliatus*, Wick; *Talpa europaea*, Tring, Boxworth, ‡ etc.; *Mustela vulgaris*, Tring; *Mustela putorius*, Aberystwyth. §

## 2. *Typhlopsylla agyrtes nobilis* subsp. nov.

This form agrees in every respect with the type, one character excepted. The subspecies shows a tendency to lose one of the genal spines on each side. In a series of over thirty examples of this flea from its host, nearly every specimen has lost one or two genal spines on one side. In several cases one from both genae has disappeared.

*Hab. Arvicola amphibius*, Tring; Brighton. †

The present species, as I have previously stated, was described by Dr. Heller in 1896. The two type-specimens, both *males*, were given him by Professor O. Schneider, who caught them on the Island of Borkum, where they were found in the sand. Since then, however, Dr. Heller has received a further supply of this insect from the same locality taken from *Arvicola arvalis*.

At the request of Dr. Heller I undertook to investigate the species, and for this purpose he most courteously presented me with two examples.

Dr. Heller's species I found to be identical with the English insect which Mr. Edward Saunders introduced into the British list as *Typhlopsylla assimilis* Taschenbg.

In *Die Flöhe*, pp. 95, 96, Dr. Taschenberg diagnoses his *Typhlopsylla assimilis* as having eighteen teeth in the pronotal comb, and a "boot-shaped" genital organ in the *male*. Dr. Heller differentiated his species from the *assimilis* of Dr. Taschenberg by its pronotal comb consisting of sixteen teeth

\* Refers to specimens in my collection only, throughout the present article.

† Messrs. Brazenor Bros.

‡ Mr. William Furren.

§ Mr. George Davis.

and by its lacking the "boot-shaped" genital organ in the *male*. To further the inquiry I applied to Mr. Ritsema of Leyden for typical specimens of *assimilis* Taschbg., which he most kindly sent me. From the above-mentioned investigations I came to the conclusion that **all** the insects I had examined both from England and the Continent were the same species, namely *agyrtes* Heller, all of them (inclusive of the specimens from Ritsema) possessing sixteen teeth in the pronotal comb. The dorsal ninth segments also were identical in all of them. The shape of this organ, however, when dissected out cannot be called "boot-shaped." Dr. Julius Wagner, *Hor. Soc. Ent. Ross.* 1898, XXXI. t. 9. f. 25, gives an illustration of the genital armature of what he calls *Typhlopsylla assimilis* Taschbg. This figure undoubtedly represents an excellent species. It would, however, be interesting to know if this is the real *assimilis* or a new species. It seems most probable that the number of teeth in the pronotal comb of the insect Dr. Taschenberg called *assimilis* was miscounted. The identity of Dr. Taschenberg's insect, however, must always remain doubtful.

In North America a closely allied species is found with fourteen teeth in the pronotal comb, which has hitherto not received a name. This form Mr. Baker considers identical with Dr. Taschenberg's *assimilis*: vide *Canadian Entomologist* XXVII. p. 190 (1895).

### 3. *Typhlopsylla dasycnemus* (Pl. XVA. fig. 4 ♂, 5 ♀).

*T. dasycnemus* Rothschild, *Ent. Record* IX. p. 159 (1897) (Tring).

The front of the head is rounded as in the previously mentioned species. The two rows of bristles in front of the antennal groove consist of five and two bristles respectively. The small spine-like tubercle is present in this species also. The gena has at its posterior edge **four** spines which stretch backwards. Near the hinder edge of the head are six bristles. Between this row of bristles and the antennal groove are six or seven more bristles of varying lengths.

The pronotum bears one series of long hairs only; at its posterior edge is a comb of **sixteen** teeth.

The mesonotum has one row of hairs on it. The episternum (+ epimeron) bears eight hairs; its shape can be best made out from the figure.

The metanotum has one distinct row of hairs on it; several small hairs, however, are scattered over its surface. The episternum is a small plate of a somewhat irregular shape bearing a single hair. The epimeron is shaped as the figure shows: it bears four hairs.

At the posterior edges of the first six tergites of the abdomen of the *male* and the first five of the *female* there is a small spine placed close to the middle line on each side. At the posterior edge of the seventh tergite there are on each side close to the middle line one long and two short bristles.

The enlarged eighth sternite in the *male* bears about three small and one large bristles. The boomerang-shaped ninth sternite differs widely from the same organ in *T. agyrtes*. It is much stouter, and bears four hairs. The tibiae, especially of the hindlegs, are very hairy. This, in fact, is one of the most striking characters of the present species.

Length 2.25—2.35 mm.

*Hab. Sorex vulgaris*, Tring and Hanover; *Talpa europaea*, Tring.

Dr. Jordan discovered this species at Tring last year: since then he has taken a



fair number of examples, chiefly on *Sorex vulgaris*. This year he took a single specimen at Hanover on the same host.

#### 4. *Typhlopsylla pentacanthus* (Pl. XVA. fig. 3 ♂).

*T. pentacanthus* Rothschild, *Ent. Record* IX. p. 65 (1897) (Tring).

The front of the head is scarcely rounded. Before the antennal groove there are six moderately long hairs. At the posterior edge of the gena are **five** spines of unequal length. The first four gradually increase in length. The fifth spine is somewhat smaller than the others, and is in the same position as the tubercle in *T. agyrtes*; it is, in fact, probably homologous with it. The back of the head bears three rows of bristles. The maxillary as well as the labial palpi are remarkable for their great length.

The pronotum bears a row of alternately arranged long and short bristles; at its posterior margin is a comb of **fourteen** teeth.

The mesonotum bears two rows of hairs. The first row consists of short hairs, and the second one of alternately arranged long and short ones. The episternum (+ epimeron) is a large plate, the shape of which can be seen from the figure: it bears five or six hairs.

The metanotum, like the mesonotum, bears two rows of hairs. The episternum is a small conical plate bearing two or three hairs. The epimeron is large, and bears four long hairs.

The first seven tergites of the abdomen bear, as usual, two rows of bristles. The first of these rows consists of small bristles of a uniform size. The second row contains alternately arranged long and short bristles. The number of these bristles appears to vary somewhat according to individuals.

At the posterior edges of both sides of the first four tergites in the *male* there are two small spines placed close to the middle line. In the *male* also there is a single spine at the posterior edges of the fifth and sixth tergites. In the *female* the two spines are present on the first two tergites only, the next three tergites having one spine only. On the sixth tergite in the *female* there is no spine. The long hairs at the posterior edge of the seventh tergite which are so characteristic of many fleas are absent in the *male*. In the *female* there are two long hairs on each side in this position. The enlarged eighth sternite in the *male* bears five long hairs at its posterior edge. The moveable portion of the ninth tergite resembles the same portion in *Typhlopsylla gracilis* Tschlb.: see Pl. XVII. f. 16. The enlarged eighth tergite of the *female* bears numerous hairs near its ventral edge, many more being present than in *T. agyrtes*.

Length 1.95—2.77 mm.

*Hab.* *Mustela vulgaris*, *Mus silvaticus*, and *Talpa europaea*, Tring; *Mustela vulgaris*, Boxmoor.\*

This species appears to be rare. It was first taken by Mr. Albert Piffard at Boxmoor, Herts, in 1893, who secured three specimens from a weasel (*Mustela vulgaris*). This insect, though recognized as new by Mr. Edward Saunders, was not described. In addition to the three original examples I had seven specimens taken at Tring, Herts, and Mr. Edward Saunders has two more from another locality. Hitherto this species has not been recorded from the Continent. The above-mentioned twelve specimens are, as far as I know, all the recorded examples of this very distinct insect.

\* Mr. A. Piffard.

## GENUS CERATOPSYLLA.

This genus contains the fleas parasitic on bats. It is an extremely well-defined genus, as pointed out by Dr. Wagner. At the extreme anterior portion of the head there are two chitinized flaps on each side. The maxillae are of the peculiar shape shown in the figure (Pl. XVI. f. 6).

In the present article I treat of eight-combed species only; and as a considerable amount has already been published on these species by Dr. Wagner, *Hor. Soc. Ent. Ross.* XXXI. pp. 26—33, I have endeavoured to call attention to the most salient features only.

5. *Ceratopsylla elongatus* (Pl. XVI. fig. 6 ♀, 8 ♀, 10 ♂).

*C. elongatus* Curtis, *Guide Gen.* p. 36 (1829): id., *British Ent.* IX. No. 417. f. (1832).

*C. subobscura* Wagner, *Hor. Soc. Ent. Ross.* XXXI. p. 32. t. IX. f. 15 (1898).

The present species, which has already been described by Dr. Wagner, *loc.*, is the largest member of the genus *Ceratopsylla* hitherto recorded from the British Islands. The pronotum and the metanotum bear combs at their posterior edges. The first six tergites of the abdomen likewise bear combs at their posterior edges.

On p. 543 I give a table showing the variation in the number of teeth in these combs, in both sexes. The episternum (+ epimeron) of the mesothorax is oval in shape, and bears about half a dozen small hairs. The episternum of the metathorax is a small plate with a few hairs on it. The epimeron, however, is large, and bears at its posterior edge two long and one short hairs—a very characteristic feature of the species. At the posterior edge of the seventh tergite in both sexes there are one long and two short bristles on each side close to the middle line. The eighth tergite in the *male* is peculiarly modified, as is shown on Pl. XVI. f. 10. The stigma is placed at the base of the dorsal posterior lobe, as I have already mentioned. The eighth sternite in this sex is much reduced, as is shown in the same figure. In the *female* the eighth tergite is, as usual, enlarged. Just before the opening of the stigma there are in the present species two small hairs, as is shown on Pl. XVI. f. 8. The seventh sternite is much enlarged in the *female*, and bears in *C. elongatus* numerous small hairs.

Length 3—3.2 mm.

*Hab.* *Scotophilus noctula*, Tring, Cambridge,\* and Brighton.†

Curtis, as I have previously notified, described this species. He gives a very accurate measurement of it in his *British Entomology, loc.*, and further states that it is parasitic on the yellow bat (*Vesperugo noctula*), its **only** host.

Dr. Wagner redescribed this species under the name of *subobscura*, as mentioned above.

I take this opportunity to correct an error of mine in this journal, *ante*, Vol. II. 1895. p. 66. Here I recorded *Ceratopsylla pentactenus* as **new** to the British list. This species, however, had been previously recorded as British by Mr. Edward Saunders in the *Ent. Mon. Mag.* (2). III. p. 66 (1892).

\* Dr. David Sharp and Mr. William Farren.

† Messrs. Brazenor Bros.

TABLE SHOWING THE NUMBER OF TEETH IN THE COMBS (*C. elongatus*).

Abdomen.							
	Proth.	Metath.	I.	II.	III.	IV.	V.
♂	44	38	40	50	46	38	31
♂	42	35	36	49	44	40	33
♂	38	34	35	44	41	35	30
♀	36	33	37	46	45	34	26
♀	37	29	32	37	36	30	22
♀	38	26	25	36	30	25	17

6. *Ceratopsylla octactenus* (Pl. XVI. fig. ♂ ♀, 9 ♀).

*C. octactenus* Kolenati, *Parasiten d. Chiropt.* p. 31 (1856), t. III. f. 31 (1857); Wagner, *Hor. Soc. Ent. Ross.* XXXI. p. 26.\* t. IX. f. 16 (1898).

The present species has been fully described by Dr. Wagner. I figure the ♀ on Pl. XVI. f. 7. At the posterior edge of the episternum of the metathorax are one long and two short hairs. Further characters are the single row of hairs on the enlarged seventh sternite of the abdomen of the *female*, and the four hairs beneath the stigma of the eighth tergite in the same sex: Pl. XVI. f. 9.

*Hab.* *Scotophilus pipistrellus*, Tring; *Vespertilio nattereri*, Tring.

7. *Ceratopsylla intermedius* sp. nov.

This species is allied to *C. elongatus*, but it is somewhat smaller.

The ninth tergite of the *male* differs from that of *C. elongatus* as follows: the manubrium is narrower; the dorsal edge is less indented and lacks one of the longest hairs. The moveable portion, moreover, is rounded at its upper edge instead of being curved (Pl. XVII. f. 15).

The species further differs in having a single row of hairs on the enlarged seventh sternite of the *female*, and only three hairs below the stigma on the eighth tergite.

Length 2.35 mm.

*Hab.* *Scotophilus serotinus*, Brighton,\* and Yalding, Kent.†

This species appears to be exclusively confined to the Serotine bat (*Scotophilus serotinus*). I have a fairly large series of it, all of which exhibit the characters mentioned above.

\* Messrs. Brazner Bros.

† Mr. Ogilvie Grant and Captain Savile Reid.

I received from Mr. William Farren of Cambridge last June a large series of *Ceratopsylla jubata* Wagner, taken from *Scotophilus pipistrellus* near Ely, Cambs. Since then I have taken a few examples at Tring from the same host. This species has hitherto been unrecorded from Great Britain.

GENUS STEPHANOCIRCUS Skuse, *Records Austral. Mus.* II, p. 77 (1893).

The genus was erected for an Australian species, *St. dasyuri*, found on *Dasypus maculatus*. I describe here another species, which I think is congeneric with *dasyuri*.

8. *Stephanocircus mars* sp. nov. (Pl. XVI. f. 11 ♀).

The front of the head is encased in a helmet-like structure, much flattened towards its anterior end. The posterior margin of this is modified into a ring of thirty-eight teeth, of a similar structure to those on the pronotum. The portion of the head immediately above the antennal groove is covered with short hairs, the position of which is shown in the figure. The antennal groove and the gena are both prolonged. The gena bears three hairs, and along its posterior margin are six strongly chitinized spines. The eyes appear to be entirely absent, but the small tubercle in the characteristic position previously referred to is present. The maxillae are elliptical in shape.

The pronotum bears three rows of bristles. The first row consists (on each side) of about six small bristles, the second of about nine larger ones, and the third of seven large and seven smaller ones arranged alternately. The posterior margin of the pronotum forms a comb of twenty-six bristles.

The mesonotum bears two rows of bristles. The first row consists (on each side) of six bristles of moderate length, while the second consists of five long and five short bristles arranged alternately. The epimeron (+ episternum) is a large plate covered with about fourteen short hairs.

The episternum of the metanotum is small, but the epimeron is much larger and bears a double row of five bristles. The first two tergites of the abdomen are ornamented with a single row of alternately arranged long and short bristles, numbering nine and eleven respectively. The third, fourth, fifth, and sixth tergites bear two rows of bristles.

The seventh tergite bears similar hairs, but has in addition at its posterior edge two long ones close to the middle line. At the posterior edges of the first, second, third, and fourth tergite close to the middle line there are two small spines on each side. A single spine is in the same position on the sixth tergite. The eighth tergite is much enlarged, and ornamented with numerous hairs. The first seven sternites bear a few hairs only. The tibiae are remarkable for their extreme hairiness.

Length 3 mm.

*Hab.* *Hesperomys* sp. (?), Argentina.

I am much indebted to Dr. Carlos Berg for a single specimen of this wonderful insect.

## EXPLANATION OF PLATES XV<sub>A</sub>. TO XVII.

vii, viii, ix, x, segments; d = dorsal, v = ventral; f = moveable process of ninth segment, p = immoveable process; m = internal process of ninth segment (= manubrium); st = stigma; c-c = coxal cavity; pst, inst, mtst = pro-, meso-, metasternum; epst = episternum; epm = epimeron; mtu = metanotum.

### PLATE XV<sub>A</sub>.

- Fig. 1. *Typhlopsylla agyrtes* ♂, p. 538.  
 „ 2. End of abdomen of *T. agyrtes* ♀.  
 „ 3. *Typhlopsylla pentacanthus* ♂, p. 541.  
 „ 4. „ *dasycnemus* ♂, p. 540.  
 „ 5. „ „ end of abdomen of ♀.

### PLATE XVI.

- Fig. 6. *Ceratopsylla elongatus* ♀, p. 542.  
 „ 7. „ *octactenus* ♀, p. 543.  
 „ 8. Two bristles beneath the stigma of the eighth segment of *C. elongatus* ♀.  
 „ 9. Four bristles „ „ „ „ *C. octactenus* ♀.  
 „ 10. End of abdomen of *C. elongatus* ♂.  
 „ 11. *Stephanocircus mairs* ♀, p. 544.

### PLATE XVII.

- Fig. 12. *Typhlopsylla agyrtes* ♂, end of abdomen, lateral view, eighth sternite removed.  
 „ 13. The same of *T. dasycnemus* ♂.  
 „ 14. The same of *T. agyrtes* ♂, from above (spread out).  
 „ 15. The same of *Ceratopsylla intermedius* ♂, from above.  
 „ 16. The same of *T. gracilis* ♂, from above.  
 „ 17. End of abdomen of *T. agyrtes* ♀, from above.  
 „ 18. The same from the side.  
 „ 19. The same from below.  
 „ 20. Sterna of *T. agyrtes*, ventral view.  
 „ 21. Metasternum of the same, lateral view.  
 „ 22. The same, frontal view. \*  
 „ 23. Mesosternum of *T. agyrtes*, frontal view.  
 „ 24. Eighth abdominal segment of *T. agyrtes*, from below (spread out).  
 „ 25. Tergite of viii. abdominal segment of same, ♀, from above.





